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Flood risk management in Italy: challenges and opportunities for the implementation of the EU Floods Directive (2007/60/EC)

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Abstract. Italy's recent history is punctuated with devastating flood disasters claiming high death toll and causing vast but underestimated economic, social and environmental damage. The responses to major flood and landslide disasters such as the Polesine (1951), Vajont (1963), Firenze (1966), Valtelina (1987), Piedmont (1994), Crotone (1996), Sarno (1998), Soverato (2000), and Piedmont (2000) events have contributed to shaping the country's flood risk governance. Insufficient resources and capacity, slow implementation of the (at that time) novel risk prevention and protection framework, embodied in the law 183/89 of 18 May 1989, increased the reliance on the response and recovery operations of the civil protection. As a result, the importance of the Civil Protection Mechanism and the relative body of norms and regulation developed rapidly in the 1990s. In the aftermath of the Sarno (1998) and Soverato (2000) disasters, the Department for Civil Protection (DCP) installed a network of advanced early warning and alerting centres, the cornerstones of Italy's preparedness for natural hazards and a best practice worth following. However, deep convective clouds, not uncommon in Italy, producing intense rainfall and rapidly developing localised floods still lead to considerable damage and loss of life that can only be reduced by stepping up the risk prevention efforts. The implementation of the EU Floods Directive (2007/60/EC) provides an opportunity to revise the model of flood risk governance and confront the shortcomings encountered during more than 20 yr of organised flood risk management. This brief communication offers joint recommendations towards this end from three projects funded by the 2nd CRUE ERA-NET (http://www.crue-eranet.net/) Funding Initiative: FREEMAN, IMRA and URFlood.

1 Introduction: flood risk profile of Italy

Italy is prone to natural hazards of many kinds including landslides, mudflows, avalanches, earthquakes, volcanic eruptions, floods, storms and storm surges, tsunami and land subsidence. Given the rugged, mountainous topography, landslide-prone geological setting, and the Mediterranean climate variability, the areas prone to significant flood and/or landslide risk exceed 29 500 km^2 ($\sim$ 9.8 % of the Italian territory) and affect more than 6600 ($\sim$ 82 %) municipalities (MATTM, 2008). In 6 out of 20 administrative regions, all (100 %) municipalities show a high exposure to landslides and floods either individually or in combination: Calabria, Trentino-Alto Adige, Molise, Basilicata, Umbria and Valle d'Aosta. A recent study (Legambiente e Dipartimento della Protezione Civile, 2010) conducted on a subset ($\sim$ 30 %) of the risk-prone municipalities found that it was common that dwellings or whole residential quarters were located in floodplains or areas exposed to landslides. Worse, in about one-half of the sampled municipalities the hazard-prone areas contained industrial facilities, and in one-fifth of the cases hospitals, schools or other public facilities. The study estimated that some 3.5 million people (6 % of the Italian population) stay in the risk areas every day.

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A systematic review of the significant hazard events (Salvati et al., 2010) recorded some 3139 landslide events and 2595 flood events in the period between 68 CE and 2008 that resulted in deaths, missing persons, injured people, and homelessness. The review was produced based on earlier inventories (Catenacci, 1992; Guzzetti, 2000; Guzzetti and Tonelli, 2004; Guzzetti et al., 2005). For the 20th century and thereafter (1900–2008), that is for the period for which the more reliable information is available, Salvati et al. (2010) report some 2713 landslide and 2321 flood events. To compare, the global Emergency Events Database (EM-DAT; www.emdat.be) records only 35 (13) flood (landslide) events for the same period, resulting in 1047 killed and some 2.8 million affected.

This brief communication synthesises the recommendations of three projects from among those funded by the 2nd ERA-NET CRUE Funding Initiative, launched in 2008 to support the implementation of the EU Floods Directive (2007/60/EC) by improving knowledge, tools and strategies for flood risk management. FREEMAN, IMRA and URFlood (see the supplementary material for more detailed information about the projects and their results). The three projects addressed complementary themes: FREEMAN revisited recent flood events and analysed risk perception and communication, performance of risk management plans and early warning systems, and aftermath legal review of the accountability for the harm and destruction caused by floods. URFlood analysed flood risk communications and interpretation in a broader context of social, cultural and individual behaviour. The IMRA project examined risk awareness and public participation, focusing on social milieus for a tailor-made participation campaign and developing a new indicator-based model for the assessment of institutional stakeholder cooperation.

2 Flood risk governance in Italy – driven by disasters

In the aftermath of the devastating 1966 flood in northern Italy and Tuscany, an interministerial commission [1] led by Prof. Giulio De Marchi (1890–1972) had been appointed to design principles of modern flood risk management in Italy, and to develop flood management standards tailor-made for the disaster-afflicted country. It took almost two decades to reach a political consensus and to sanction a new flood risk legislation based on the recommendations of the De Marchi Commission. The law 183/89 of 18 May 1989 introduced several key principles of effective water and flood risk management later embraced also by the EU Water Framework Directive (WFD, 2000/60/EC) and the EU Floods Directive (FD, 2007/60/EC). River basins (RBs) were adopted as a planning and management unit. Throughout the country, RBs of national, inter-regional and regional importance were designated, and river basin authorities (RBAs) were established for each of them. The flood and landslide management plans (in Italian *piano di assetto idrogeologico*, PAI), formally a part of the river basin plans (RBPs), were to identify areas prone to risk of different intensity: $R4$ classifies areas prone to risk involving loss of life or significant injuries, sizeable damage to property and infrastructure, and significant damage to economic activities. $R3$ denotes areas that are prone to risk involving harm to humans, property or lifelines. $R2$ and $R1$ encompass minor or limited risks with no direct threat to persons and economic activities.

The development of the comprehensive RBPs proved to be more demanding than initially thought and lasted for more than a decade. In 1993, the decree law 398/1993 made it possible for RBAs to develop the plan in a piecemeal way, and hence to finalise and enact the PAIs even if the RBPs have not yet been completed. But a stringent deadline for completing PAIs was introduced only after the disastrous flood and landslide event in Sarno (1998). The decree law 180/1998 (converted into law 267/1998) required that PAIs be adopted by December 1998, later postponed to June 1999. The law 267/1998 demanded the identification of the infrastructure and buildings in areas prone to risk and envisaged programmes for relocation where necessary. In addition, the law empowered the prime minister and the council of ministers to step in and develop programmes of risk reduction measures for the RB where the deadline was not met.

Soon enough, the deadline was extended to June 2000 by the decree law 132/1999 (converted into the law 226/1999). However, for the areas exposed to highest risk (i.e. $R4$ and $R3$ flood-prone areas), special risk management plans were to be ready by October 1999. Moreover, for these areas the civil protection authorities were required to develop emergency plans containing measures for the protection of the populations exposed to the risk, including early warning and preventive evacuation, within the six months after the approval of the special plans.

In the aftermath of the Soverato 2000 flood, in view of the difficulties in complying with the provision of the law, the deadline was postponed once again, to April 2001. In addition, Article 2 of the law 365/2000 establishes that, within 120 days from the date of entry into force of the law, exceptional monitoring and reconnaissance operations were to be carried out along waterways and relevant floodplains. These inspections were to identify the areas prone to high hazard and to determine the most urgent risk mitigation measures to be put in place in order to safeguard life and property.

In 2006, the water and flood risk legislation was consolidated and unified through the legislative decree 152/06, the piece of legislation which transposed, with delay, the provisions of the WFD. A few years later, the FD was transposed by the legislative decree 49/2010 of 23 February 2010. In agreement with the FD, the decree 49/2010 mandated preliminary flood risk assessment (PFRA), assessing potential risks based on readily available information such as instrumental

[1] Commissione interministeriale per lo studio della sistemazione idraulica e della difesa del suolo Roma – 1970

records and long-term assessment. On the basis of PFRA, river basin authorities are to identify areas prone to potentially significant flood risks, and to develop flood risk management plans coordinated at the river-basin-district level.

Compared to the risk prevention and protection, the legislation on risk response and recovery developed more quickly and became more copious as it involves a variety of administrative divisions with different functions and responsibilities for management of emergencies. First introduced in the early 1970s, the organisation and structure of the civil protection had substantially matured through the 1990s. The Civil Protection Service (CPS) refers to all the organisations and activities set up by the state to safeguard the integrity of human lives, goods, settlements and the environment against the damage and hazards deriving from natural disasters and catastrophes. The CPS is managed by the Department for Civil Protection (DCP), which is subordinated to the prime minister (president of the council of ministers). The CPS is triggered in the situation that the hazard management requires a coordination of multiple governing bodies, or if the management requires application of extraordinary means and powers.

The DCP coordinates the emergency response and operates the hazard monitoring through a network of so-called functional multi-hazard centres (FMCs) established in early 2000. The FMCs monitor continuously atmospheric and maritime conditions, all year around, 24 h a day, 7 days a week when necessary. The information from FMCs informs civil protection operations and emergency management authorities in decision making. The network is composed of regional functional centres (RFCs), a central functional centre managed by the DCP, and a number of knowledge centres for scientific and technical support.

The law 59/1997 of 15 March 1997 delegated administrative functions and responsibilities related to civil protection, previously held by the state, to the regions and other autonomous bodies. The regions, which also hold emergency management responsibilities, issue regional legislation on civil protection, identifying and taking charge of administrative responsibilities which require unified region-wide coordination, and assigning all other functions to the provinces and town council. The regions set up and implement regional forecast and prevention programmes in agreement with the provisions of national programmes. The provinces contribute to the organisation and implementation of the activities of the CPS by collecting and processing data relevant for civil protection activities, and by setting up and implementing province-level forecast and prevention programmes. The mayors are the municipal authority for civil protection. When an emergency occurs within municipal territory, the mayor directs and coordinates relief and assistance services to aid disaster-stricken people, and s/he adopts the necessary measures.

3 Challenges and opportunities

Italy's vulnerability to floods and other natural hazards is amplified by weak enforcement of building restrictions and low compliance with sound floodplain management principles. Increasing population and concentration of wealth in flood-prone areas, along with continuing practice of soil sealing at the current pace, will inevitably lead to higher flood losses. Amnesties for infringement of building regulations in 1985, 1994 and 2003 have undermined efforts to curb construction abuses and to ensure compliance with flood risk protection norms. The 2000 Soverato and 2006 Vibo Valentia flood events are examples of the disastrous consequences of both construction abuses and their successive legalisation.

The past disaster strikes offer costly but valuable lessons. These lessons need to be understood and translated into tangible advances of risk governance. A systematic aftermath review of the significant damaging events is rarely conducted or not in a sufficient depth. The review has to provide insights into economic costs and social hardship suffered from the disaster strikes, taking into account the direct, indirect and intangible damage to economic sectors, human health, community well-being, and environment. The knowledge of the full social costs of a disaster is fundamental for an efficient recovery aid and assistance, and for improving the understanding of our vulnerability to nature's "caprice". Furthermore, the review should help to identify the drivers of risk, including the gaps in normative framework and its practical implementation and enforcement, and perverse incentives to engage in activities that amplify the risk. The event analysis should include institutional responses to disaster strikes, skills of the early warning systems and preparedness arrangements.

Climate-change-induced alteration of rainfall patterns (form, intensity and timing of rainfall) is very likely to have significant effects on frequency and intensity of floods, if no appropriate risk mitigation measures are put in place. The FD made consideration of the climate change optional until the first review of the preliminary flood risk assessment in 2018 (Article 14 and recital 14). The decree 49/2010 followed suit. This means that the risk mitigation measures to amplified climate threats may only be adopted in 2021 and put in place in years to follow, thus likely not to be effective before 2025. This is too late to provide a strategic guidance to the adaptation efforts in other sectors, especially territorial and urban development. It is very important to devise robust scenarios of likely climate change within the river basin districts (RBDs), and periodically revise them to take into account new and better knowledge. These scenarios should be shared and inform all strategic planning decisions in agriculture and rural development, energy generation, water resource management, urban and territorial planning and disaster risk reduction.

The flood risk management in Italy has evolved as a response to (many) large natural calamities. As a result, the normative framework is punctuated with ad hoc and insufficiently coordinated pieces of legislation. Whereas disaster response legislation is copious and internally consistent, the normative frameworks of risk prevention and protection are fragmented and of limited scope. The implementation of the FD in Italy provides an opportunity for breaking this practice. Back in 1989, the law 183 introduced principles of modern and systematic flood risk management. Insufficient resources and capacity prevented a rapid implementation of these principles. In 2010s the challenges and stakes are higher than in late 1980s or early 1990s. Flood risk management nowadays has to correct past missteps and take into account the new challenges, including climate change. A new legislative framework is needed to harmonise and make internally and externally consistent the legislation on water management, soil defence, territorial development, building regulation, civil protection, and climate change adaptation. However, instead of reforming the existing flood risk planning instrument initiated in 1989, the law 49/2010 introduces an additional one, and provides little guidance for the harmonisation of both.

The Civil Protection Mechanism in Italy is well organised and serves as a best example practice for other countries, as testified by the review conducted by the Organisation for Economic Co-operation and Development in 2010 (OECD, 2010). The network of multi-risk surveillance and early warning centres established by the DCP, the regions and autonomous provinces provides critical and timely information for disaster response operation. As in few other countries, the modern monitoring and surveillance systems have been seamlessly incorporated in a flood risk management scheme encompassing all disaster stages. However, frequent local deep convective storms, along with rugged, mountainous topography and landslide-prone geological setting make it difficult to alert the citizens of a flood in sufficient time to take the necessary actions. Localised intense precipitations are not uncommon in Italy. In Vibo Valentia back in 2006, some 200 mm of rain fell over a period of less than 3 h. Most recently, on 25 October 2011 an intense rainfall of over 500 mm in less than 6 h caused flash floods across the territory of the province La Spezia (Liguria), particularly rugged coast of Cinque Terre (the Five Lands); and the province Massa-Carrara (Tuscany). These examples underline the critical importance of systematic flood risk prevention and protection. Repeatedly, DCP has been subjected to criminal investigation for failing to issue flood warnings. It is important to realise the limitations of flood forecasting and make efforts to reduce vulnerability to extreme precipitation and flash flood events that are hard to predict with sufficient temporal and spatial resolution. Still, subjecting the performance of the established monitoring and surveillance systems to an independent and constructive review can help to shield the establishment from legal indictment while providing useful advice for further development of the systems.

In responding to natural calamities, it has become an increasing practice to resort to declaration of "state of emergency" (SoE) consenting to issue decrees that supersede most ordinary legislative provisions. The extraordinary power is legitimate to protect human life, property and environment when there is no other way to this end (state council no. 2361/2000). However, systematically resorting to the application of the decree of DCP as a normative response to disasters creates a situation of a protracted "state of emergency" as follows: in the aftermath of a natural disaster, the declaration of emergency clears the way for emergency decrees and ad hoc legislative activities. A subsequent disaster event stretches out the existing state of emergency or prompts a declaration of a new one, further legitimising the excessive use of emergency decrees. As a result of the above practice, the decrees of civil protection, initially devised to tackle catastrophic outcomes of natural hazards, have become ordinarily applied instruments of flood risk regulation and management. In other words, there is a tendency to respond to disasters only after these occurred, rather than putting major efforts into stopping them from happening. Declaration of SoE should be limited to the time during which the immediate threat persists and the time needed to implement critical interventions in the aftermath. Ordinary flood risk management institutions should ensure a timely execution of all interventions, both structural and non-structural, necessary to prevent a similar emergency from occurring again.

Accountability and public engagement are key principles of good governance in general and even more so in the case of flood risk management. Public participation and dialogue in the context of FD can serve multiple purposes including increased risk awareness, development of robust and socially accepted risk scenarios and management measures, and development of effective risk communication strategies.

Despite many efforts to pin down resilience in terms of measurable indicators and indices, there is little agreement about what is the most appropriate scale, level of (dis-)integration, functional relationship and trade-off between the various constituents of resilience. We argue that more than anything else, resilience is knowledge – knowing how to prepare, respond and recover from hazard strikes. More than that, resilience has the capacity to deploy that knowledge, to help people get back on their feet after having sustained a blow, and to learn how to do so.

Resilience has many forms and manifestations: people convalescing after having lost what was dear to them, communities recovering from shattering blows, and economies getting back on track after having sustained major shocks and losses. However, resilience may also have a negative connotation: the persistent overlooking of the threat and perceived powerlessness of individuals, demonstrated through our research (see the supplementary material) in the foreground of an unacquainted community or nonsensical institutions. The institutional preparedness can be boosted, among others, through the deployment of early warning systems (EWSs) and emergency plans. The reliability and technical sophistication of the EWS is an important aspect of resilience, one which allows "buying" time to prepare for an imminent strike. However, the "lead time" gained from the deployment of advanced EWS must not get lost to ineffective risk communication or to "not knowing" what to do in the wake of the disaster. Once again we note that resilience is about knowledge, in this case not only what to do but what to do first.

Appendix A

The FP6 ERA-NET CRUE initiative was launched in order to boost the co-ordination and integration of regional, national, and EU research programmes and policies in the flood risk management field. In order to support the EU action programme on flood risk management (COM(2004) 472final) and the implementation of the FD, the CRUE consortium promoted two joint funding initiatives to establish transnational collaborative research projects on specific areas related to flood risk management. Although designed separately, the research conducted in Italy in the context of the projects FREEMAN, IMRA and URFlood produced complementary results.

FREEMAN project set to revisit recent flood events across Europe and identify factors and measures that boost community resilience to floods. The Italian case study focused on the 2000 Soverato and 2006 Vibo Valentia floods in Calabria. The research included inter alia analysis of the risk perception and communication; performance of the early warning systems, evaluation of the predictability and return period of the analysed extreme events; and the normative and judicial review of the flood risk institutions at the national and regional scale. The latter has offered important lessons learned.

Triggered by intense precipitation lasting for several days, an otherwise innocuous torrent, Beltrame/Soverato turned in the early morning of 10 September 2000 into a monster destroying anything in its way, including a camping site Le Giare situated in the least appropriate place, the bed of the torrent close to the outlet into the Ionian Sea. The death of 13 victims, mostly physically impaired persons, sparked a public outcry that unsettled the disaster risk governance in the country. As an immediate response to the event, the Soverato decree, later turned into law 365/2000, demanded a quick compliance with the flood management provisions introduced back in 1989.

The trial in the aftermath of the Soverato 2000 flood saw initially eight people faced with the charges of multiple manslaughter and negligent behaviour. Four were acquitted and four were found guilty in all successive stages of appeal. In March 2009 the court handed down the sentence of guilty of manslaughter to Egidio Vitale, the owner of the camping, Vincenzo Citriniti, the director of the Territorial Office Catanzaro division, and Silvestro Perrone, employer of the region administration. The trial shed light on how the court interpreted uncertainty and (un)predictability of the extreme meteorological and hydrological events. The expert witnesses held very different beliefs with respect to what was the approximate probability (return period) of the precipitation event and the likely river discharge at the peak flow. The reconciled view attributed a lower than 100–110 return period to both. However, the notion of "return period" is only marginally relevant for the sentence. In legal terms, an event is unforeseeable if it is believed that it will never occur; certainly not an event that is, at least in reasonable likelihood, estimated to occur on average every 80, 90, 100, 110 or even 120 yr. Therefore, in legal terms, events of this kind shall be considered fully foreseeable (if not certain). In other words, if the occurrence of an event can be envisaged and an average interval of time can be estimated for its re-occurrence, then in legal terms such an event cannot be considered unforeseeable or exceptional.

Moreover, the legal proceeding shed light on the practice that has led to issuing a licence for public land use in a flood-prone area. Since the late 1980s when the licence was first requested and initially denied, the public authorities issued permits to use the riverbed and certified the safety of the place (although only for the summer period) five times. Interesting to note is also the nature of the hydraulic permit approval (a sort of place safety certificate, HPA) and, in particular, its role in deciding whether or not to grant a public land use licence. The judges defined the HPA as "a technical opinion on the compatibility of land use with good water regime, which provides an assessment to safeguard specific public interests". It is therefore a proceeding aimed at authorising specific activities based on a discretionary (technical) assessment "of the damage that such activities could cause to public interest". The judge of the Court of First Instance stated that HPAs, if negative, have to be taken into account. Otherwise, a positive HPA does not imply that a public land use licence has to be released, and thus it is the discretion of the respective public authority whether or not to grant a license.

The second revisited flood event occurred in Vibo Valentia, the capital of the province of the same name, home to almost 34 000, situated on hills and near the Tyrrhenian Sea. On 3 July 2006, the suburbs of Vibo Valentia – Vibo Marina, Bivona and Longobardi – were hit by a flood triggered by torrential precipitation uphill. The disaster triggered criminal investigations for environmental disaster, personal injuries and manslaughter. High-ranking officers of the Civil Protection Department (DCP) were accused of alleged failure to alert the population of the intense precipitation event and ensuing flood risk. The accusations were later dropped, and a second inquiry has been initiated and not yet concluded, addressing urban sprawl, infringement of local building regulations, and other wrongdoing.

URFlood analysed flood risk communications in a broader context of social, cultural and individual behaviour. In particular, the project analysed how information about risk is interpreted and used by the local population. In the Italian

Table A1. URFlood survey results – within cities comparison (f number/fraction of interviewed citizens with specific characteristics; M perception measure; p highlighted in bold depicts statistical significance at 5 % level).

DVs	Context	Measure	Test (df)	Value	Sig.
Past flood experience (never)	Rome	$f = 28$ (low risk area) $f = 26$ (high risk area)	χ^2 (1, 112)	0.314	$p = 0.575$
Past flood experience (never)	Vibo Valentia	$f = 21$ (low risk area) $f = 3$ (high risk area)	χ^2 (1, 103)	14.623	$\mathbf{p = 0.000}$
Past flood experience (at least once)	Rome	$f = 27$ (low risk area) $f = 31$ (high risk area)	χ^2 (1, 103)	0.314	$p = 0.575$
Past flood experience (at least once)	Vibo Valentia	$f = 34$ (low risk area) $f = 45$ (high risk area)	χ^2 (1, 112)	14.623	$\mathbf{p = 0.000}$
Flood risk perception	Rome	$M = 2.61$ (low risk area) $M = 3.23$ (high risk area)	F (1, 76)	9.46	$\mathbf{p = 0.003}$
Flood risk perception	Vibo Valentia	$M = 3.59$ (low risk area) $M = 4.01$ (high risk area)	F (1, 92)	11.035	$\mathbf{p = 0.001}$
Relative flood concern	Rome	$M = 0.82$ (low risk area) $M = 0.98$ (high risk area)	F (1, 101)	6.811	$\mathbf{p = 0.010}$
Relative flood concern	Vibo Valentia	$M = 0.99$ (low risk area) $M = 1.05$ (high risk area)	F (1, 100)	4.090	$\mathbf{p = 0.046}$

Table A2. URFlood survey results – between cities comparison.

DVs	Measure	Test (df)	Value	Sig.
Past flood experience (never)	$f = 54$ (low risk city, Rome) $f = 24$ (high risk city, Vibo Valentia)	χ^2 (1, 215)	14.406	$\mathbf{p = 0.000}$
Past flood experience (at least once)	$f = 58$ (low risk city, Rome) $f = 79$ (high risk city, Vibo Valentia)	χ^2 (1, 215)	14.406	$\mathbf{p = 0.000}$
Flood risk perception	$M = 2.93$ (low risk city, Rome) $M = 4.14$ (high risk city, Vibo Valentia)	F (1, 211)	83.227	$\mathbf{p = 0.000}$
Relative flood concern	$M = 0.90$ (low risk city, Rome) $M = 1.02$ (high risk city, Vibo Valentia)	F (1, 212)	10.193	$\mathbf{p = 0.002}$

case study, research was in the city of Rome and the city of Vibo Valentia. Both cities have a long track of severe and less severe floods, but it is widely accepted that Vibo Valentia is more prone to flood hazard (Bonaiuto et al., 2011). The scope of the study was to analyse the risk perception and analysis separately in each city as well as in comparison to each other. The empirical study has been designed to examine whether people living in areas prone to high flood risk have more pronounced experience, risk perception, relative concern about the threat, and thus they should act in a better way to cope with the threat. In addition, it was expected that citizens of Vibo Valentia, because exposed to higher hazard level, would outperform the citizens of Rome in all above measures.

A number of dependent variables (DVs) were used in the survey. The questionnaires were administered several times in 2010 and 2011. In accordance with the expectations, the results show that in Vibo Valentia, afflicted more recently and frequently with flood, more people experienced floods in areas prone to higher risk (see Table A1). On the contrary, the citizens of Rome living in areas exposed to different levels of hazards have displayed little difference in the personal experience of flood. In both cities though, higher risk perception and concerns were observed in areas prone to higher hazard level. Surprisingly, no significant differences were observed in the behavioural intention measure.

The comparison of the two cities' context (see Table A2) revealed that a significantly higher (lower) number of citizens in Vibo Valentia, compared to citizens of Rome, have (never) experienced flood. Consistently, higher flood risk perception and relative flood concern was observed in Vibo Valentia than in Rome. Yet again, no significant differences among Rome and Vibo Valentia citizens in the behavioural intention measures were found. Even if the people living in areas prone to higher hazard level have more extensive past

Table A3. Details of the FREEMAN project.

FREEMAN – Flood REsilience Enhancement and MANagement: a pilot study in Flanders, Germany and Italy	
Duration from/to	September 2009–September 2011
Website	http://www.feem-project.net/FREEMAN/
Partners	Antea Group (former Soresma) (Flanders), Seeconsult (formerly Seecon) (Germany), and Centro Euro-Mediterraneo sui Cambiamenti Climatici (Italy)
Case studies	Demer river basin (Flanders): 2002 flood event; Leine and Innerste river basins (Germany: 2007 flood event), and Calabria region (Italy: 2000 flood event in Soverato and 2006 flood event in Vibo Valentia)
Contact	Trui Paula Uyttendaele, Antea Group, Belgium, Trui.Uyttendaele@anteagroup.com
Project funded in the framework of the 2nd ERA-NET CRUE Research Funding Initiative by Waterbouwkundig Laboratorium (Flanders), Bundesministerium für Bildung und Forschung (Germany), and Istituto Superiore per la Protezione e la Ricerca Ambientale (Italy).	

flood experience, perceive higher flood risk and are more concerned about the flood issue, they do not show significant differences in the way they would behave in case of an incoming flood.

In other words, people seem to be aware of the risk they are subjected to, but they do not behave accordingly to those perceptions and concerns. Therefore one possible implication of these results is that it is not so much important to improve communication about risk perception and concern per se: it is equally important to improve the communication about how citizens should behave in case of flood. The URFlood addressed this more in detail, by giving guidelines on ways to improve flood risk communication in order to address local behaviours and to increase the resiliency of the affected communities (Bonaiuto et al., 2011; Bradford et al., 2012; O'Sullivan et al., 2012). Indeed, according to O'Sullivan et al. (2012) and consistent with the abovementioned results, for a flood risk communication to be effective it is fundamental to improve awareness about the current flood information sources among the citizens at risk, and to develop clearer and more understandable statements on flood risk.

The main focus of the *IMRA* project (Firus et al., 2011a) was to improve risk awareness and public participation, compelled by Articles 9 and 10 of the FD. The project tested two novel methodological approaches – social milieus for a tailor-made participation campaign (aiming at the broad public) and a new indicator-based model for the assessment of institutional stakeholder cooperation (Fleischhauer et al., 2012). The survey on risk perception and management carried out in the context of the project underlined that the communication actions of the project had positive effects. The survey involved schools, volunteers organisations and civil protection. Teachers and students were spokespersons for their families for things learned about flood risk, increasing individual and collective awareness. A qualitative analysis from the survey underlines that the knowledge and people's flood risk awareness was considerably increased after the communication actions.

Table A4. Details of the URFlood project.

URFlood – Understanding uncertainty and risk in communicating about floods	
Duration from/to	September 2009–August 2011
Website	http://www.macaulay.ac.uk/urflood/
Partners	The James Hutton Institute (former Macaulay Land Use Research Institute, Scotland), Suomen ympäristökeskus (Finland), University College Dublin (Ireland), Centro Interuniversitario di Ricerca in Psicologia Ambientale (Italy), Collingwood Environmental Planning (UK)
Case studies	Rovaniemi (Lapland Province, Finland), Ballinasloe (County Galway, Ireland), Clonmel (County Tipperary, Ireland), Dodder river basin (Dublin, Ireland), Wexford town (County Wexford, Ireland), Rome Prima Porta (Lazio, Italy), Vibo Valentia (Calabria, Italy), Cathcart (Glasgow, Scotland), Huntly (Aberdeenshire, Scotland), Moffat (Dumfries and Galloway, Scotland), Newburgh (Aberdeenshire, Scotland)
Contact	Kerry Waylen, the James Hutton Institute (Aberdeen, Scotland), kerry.waylen@hutton.ac.uk
Project funded in the framework of the 2nd ERA-NET CRUE Research Funding Initiative by the Ministry of Agriculture and Forestry (Finland), Istituto Superiore per la Protezione e la Ricerca Ambientale (Italy), Office of Public Works (Ireland), Environment Agency (England), and the Scottish Government.	

Table A5. Details of the IMRA project.

IMRA – Integrative flood risk governance approach for improvement of risk awareness and increased public participation	
Duration from/to	September 2009–August 2011
Website	http://www.imra.cnr.it
Partners	Technische Universität Dortmund (Germany), Umweltbundesamt GmbH (Austria), Amt der Kärntner Landesregierung (Austria), CNR – Istituto di Ricerche sulla Popolazione e le Politiche Sociali (Italy), Autorità di Bacino Fiume Tevere (Italy), T6 Società Cooperativa (Italy). Associated partner: Wupperverband (Germany)
Case studies	Wupper river basin (Germany), Möll river basin (Austria), Chiascio/Tiber river basin (Italy)
Contact	Stefan Greiving, Technische Universität Dortmund, Institute of Spatial Planning (IRPUD), stefan.greiving@tu-dortmund.de
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Stakeholder participation has a large range of possibilities of activities. In Italy, it takes the form of planning conferences (in Italian *conferenze programmatiche*), introduced by the Soverato law (365/2000), which are expected to review the draft flood management plans, and include representatives of the relevant administrations and authorities. The involvement of the general public is new in the Italian flood risk legislation. The public participation (PP) should go beyond an information campaign, and contribute to improve knowledge and awareness of flood risk. As one of the IMRA outputs, a handbook for an effective PP in flood risk management has been developed and tested in three river basins (Firus et al., 2011b).

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